INTEGRATED LOGISTICS SUPPORT (ILS) OVERVIEW; by Chuck Sproull 7/97

51. Supportability Analysis (used to be called Logistics Support Analysis - LSA) is the supportability portion of systems engineering. It is a systematic way to ask all the questions and gather the data and information needed to plan for every aspect of support for a new system. The LSA process has three phases; data gathering, data input, and reporting. Data gathering is done systematically, according to a set of 15 tasks and 77 subtasks. Acquisition Reform of 1996 has caused the original MIL-STD-1388.1A for LSA to be rewritten as the Acquisition Logistics Handbook. Also, the number of formally (contratually) stated tasks and data elements has been greatly reduced. The original LSA tasks are presented here as a conservative measure, to help preserve the full scope of support-related considerations.

LOGISTICS SUPPORT ANALYSIS (LSA 51
(WAS MIL-STD-1388.1A, NOW ACQUISITION LOGISTICS HANDBOOK)

GENERIC SETS OF LSA TASKS	**TASK SECTIONS - SERIES:**	**TASKS**
MANAGE	100 PROGRAM CONTROL	101 DEVELOP EARLY LSA STRATEGY 102 LSA PLAN, UPDATES 103 PROGRAM AND DESIGN REVIEWS
ANALYZE AND SYNTHESIZE	200 MISSION AND SUPPORT SYSTEM DEFINITION	201 USE STUDY 202 MISSION HARDWARE, SOFTWARE AND SUPPORT SYSTEM STANDARDIZATION 203 COMPARATIVE ANALYSIS 204 TECHNOLOGICAL OPPORTUNITIES 205 SUPPORTABILITY AND SUPPORT-RELATED DESIGN FACTORS
	300 PREPARATION AND EVALUATION OF ALTERNATIVES	301 FUNCTIONAL REQUIREMENTS 302 SUPPORT SYSTEM ALTERNATIVES 303 EVALUATION OF ALTERNATIVES AND TRADEOFF ANALYSIS
	400 DETERMINE LOGISTICS SUPPORT RESOURCE REQUIREMENTS	401 MAINTENANCE TASK ANALYSIS 402 EARLY FIELDING ANALYSIS 403 POST PRODUCTION SUPPORT ANALYSIS
TEST AND CORRECT	500 SUPPORTABILITY ASSESSMENT	501 SUPPORTABILITY TEST, EVALUATION AND VERIFICATION

100 series tasks deal with LSA planning and overall program management and control. LSA planning tasks occur at the beginning of a program and LSA influence during program reviews occurs throughout the remainder of the program.

200-400 series tasks are the analytical portion of LSA. An example of an LSA Task, the 201 Use Study, was presented earlier for my 67 Dodge Dart. For systems installed aboard aircraft, having use rates of several hours per sortie, which are flying several 6-hour sorties per week, used in 15 squadrons of 9-aircraft each, having three 3-month deployments per year, this use study can involve some fairly complex math.

200 series tasks are for defining the prime equipment and its support requirements, with emphasis on using as many standard parts and tools as possible, studying the support of comparable systems already being used, looking for ways to improve support using new technology (like built-in automated test equipment, and advanced and automated warehousing techniques), and designing supportability into the prime equipment.

300 series tasks examine pros and cons of alternative support possibilities.

400 series tasks are for further defining support requirements.

500 series tasks are for examining operational test results for completeness of supportability evaluation.

As a result of doing 200-400 series tasks (especially 201, 203, 205, 301, 401), data is input into an LSA Record data base. LSAR can consist of over 500 data elements for each repairable item, replaceable assembly, subassembly and part in a system. Data elements include item identification data like part number, manufacturer, national stock number, model, serial number, LSA Control number,... and technical information related to all the ILS elements, like planned annual operating hours, predicted (and later on actual) MTBF, MTTR, size, weight, unit of issue, cost, repair tasks, personnel skill categories required for repair, tools and test equipment, packaging requirements ...). The LSAR is more than just a data base, it can also make calculations of replacement rates based on MTBF, MTTR and AOR.... Earlier (MIL-STD 1388.2A) LSAR data bases are rows and columns of data. This was superseded by 1388.2B LSAR consisting of relational data tables.

As the equipment program advances through development and production, LSA Reports are output to assist managers in buying required support resources. These outputs include lists of spare parts for provisioning, tools and test equipment needed for maintenance and repair, summary of personnel skills required to support the system, maintenance tasks and technical manual outline...

In many earlier programs, where the mind set of managers and engineers viewed ILS and LSA as separate activities to do after the engineering was well on its way, one person from one activity would do the provisioning on one version of the equipment, and later on another person from a different activity would write the technical manual for a different version. The glaring result of this is disagreement in part numbers and repair procedures. But when LSA is done first, as part of system engineering, and changed are documented in the LSAR, then logistics support products derived from that LSAR all agree.

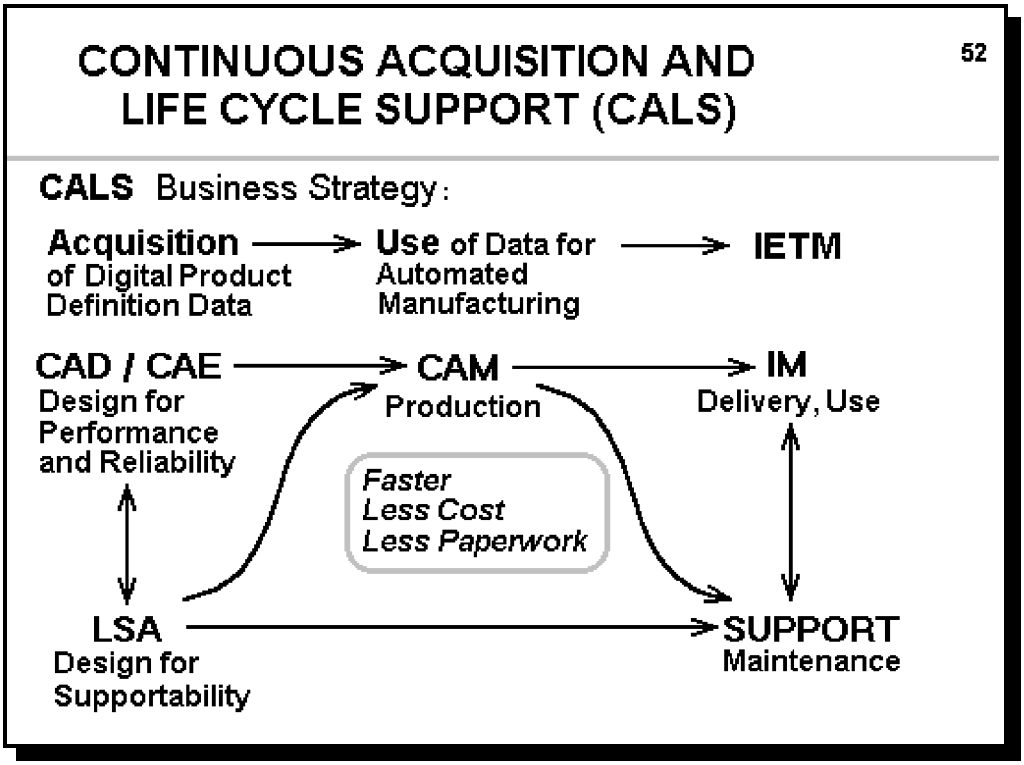
A recent DoD initiative called "Acquisition Reform" includes the movement away from mandatory use of Military Specifications and Standards to established and mature commercial, national and international specifications and standards. Now, all Military Specifications and Standards that have equivalent commercial versions, and all but the most important LSA data requirements, are being cancelled. Some international commercial standards (like ISO-9000 Quality Program Standard) are good enough that defense industry really doesn't need many of those older MIL-STDs.

In the past, LSA had no direct commercial equivalent, but commercial industry does many of the tasks and collects most of the product and support data used in LSA. So MIL-STD-1388.1A standard for LSA Tasks is being rewritten in two forms - as a Military Handbook for guidance to defense industry in developing new systems, and as a commercial handbook for guidance in developing more supportable airplanes, cars and other commercial products. MIL-STD-1388.2B LSAR is being rewritten as a Data Specification and will include descriptions and formats for about half of the original 518 data elements. Since technical data development and procurement is so expensive, it is hoped that only the most important data will be used and the typical "check the box" type of interim or oversight data will be eliminated, thereby reducing program costs.

Some of the most important trends over the past 40 years is creation of digital data for reduction of paperwork and networking of enterprises for reduced time and expense of business operations. Many companies have developed their own internal computer networks, operating systems and applications software to meet their individual needs. These independent networks are referred to as "islands of automation." As business opportunities expanded across enterprises, and now even globally, they found it difficult for their networks to pass data. Their different file structures and formats were incompatible. So, in order for these "islands of automation" to work together, "bridges" were built. Some companies developed new hardware and software to do file conversions. This enabled data, information, and digitized business forms to pass from one island to another. In other partnerships, the sending company would have to print out and deliver their data on paper, and the receiving company would then have to key punch or scan the

data back into their computer. This turned out to be an expensive, time consuming and bulky way to do business. When the government bought expensive technical data from manufacturers to support new weapon systems, they actually bought the same data several times by different names because the names of the data elements and the reports were not standardized.

In the early 80's, high-level representatives from government and industry developed some plans in an attempt to overcome these inefficiencies. The names given to these initiatives are (1) EDI (electronic data interchange), also called EC (electronic commerce), for computer to computer exchange of business forms. This enabled automated business transactions, and (2) CALS for exchange of technical data and drawings.



52. CALS (Continuous Acquisition and Life Cycle Support) is a business and technical strategy whose major goals and objectives are to (1) decrease "cycle time" ("time to market", "process/workflow cycle time, etc., for example); (2) Decrease product life-cycle cost; and (3) improve quality assurance and reliability of products and their service life-cycle. CALS can be simply defined as "technical assessment and application." Various technical approaches are assessed for how well they would satisfy a requirement and how cost-effectively they could be applied in industry. CALS involves the use of software "tools" and the processes using those "tools" to meet the goals and objectives of specific tasks, projects and entire programs. These are outlined in a document called the CALS Implementation Plan (CALSIP). The CALS process starts with a basic plan for defining products and their life-cycle support requirements from pre-concept to disposal. The DoD Acquisition Plan concept can be used as an outline for this plan.

Product definition begins with a performance specification (for operational functionality). The next step in product definition is development of a detailed engineering drawing and product Technical Data Package (TDP). Currently CALS requires product definition to be "digital" to be compatible with and usable in a world of electronic communications, computer-aided design, computer-aided manufacturing (CAD/CAM), and now flexible computer-integrated manufacturing (FCIM). Effective execution of the CALS strategy requires the development and implementation of and Automated Product Management (PDM) system, which includes a Configuration Management function as defined in an ILS environment.

The original CALS environment within DoD included development and use of specific and strict CALS Specifications and Standards for "tools" and processes. This approach was not successful because some of the tools were proprietary or "closed" (specific to a particular application and incompatible with others). Acquisition Reform has mandated migration away from "closed" proprietary "tools" to Commercial off-the-shelf (COTS) "open" software, hardware and workflow solutions.

The CALS strategy and planning should result in a capability to function in a "virtual" product development, acquisition/manufacturing and life-cycle support environment in which any contributing enterprise (industrial activity) can execute plans and commitments in a more efficient and effective manner, which can be measured by enterprise management "tools" for program assessment. One of the target objectives for CALS-driven initiatives is to facilitate product acquisition and transmission of digital product data using EC/EDI technology in a competitive "world environment." The introduction of Internet and World Wide Web (WWW) capabilities has enabled CALS goals and objectives to be achievable and affordable. The old rigid, Miliary Specification and Standard driven CALS "tools" and processes have given way to a new, "open" suit of CALS "tools and processes which can function in the new "virtual" enterprise environment. (Text for V Graph 53 contributed by Bob Roach, CALS Advocate for NWSC Crane (Code 6044)).

53. In order to help CALS happen, the following standards were developed:

a. Format for transmission of digital data between computers and across networks,

b. Format for storage and delivery of digital data on magnetic media,

c. Standard Generalized Mark-up Language (SGML) format to standardized formats of technical manuals and other common documents,

d. Hyper-Text Mark-up Language (HTML) format for documents displayed on the Internet.

e. Raster scanned images of technical manual illustrations and drawings (.BMP (bitmap), .TIF, .PCX, JPEG, other),

f. Vector images of drawings (for example, AUTOCAD .DXF files),

g. Weapon system data base file (WSDBF) and Contractor integrated technical information system (CITIS) are the government and industry versions of a standard shared distributed data base containing all identification and technical data about all the parts in a weapon system. LSAR is a significant portion of this data base.

Two of the many programs designed to implement these standards are: a. Standard for the Exchange of Product Data (STEP), for developing digital drawings of mechanical parts with so much detail they can be used as inputs to the automated manufacturing process.

b. Interactive Electronic Technical Manuals (IETM), a small set of light weight compact disks that replace 26 tons of paper technical manuals aboard US Navy cruisers, enabling then to cruise 5" higher in the water and use less fuel per mile, or to make room for carrying more personnel or more equipment. IETMs enable repair technicians to examine technical manual text (fault localization and repair procedures) and digital engineering drawings to isolate failures and to find replacement parts for a mechanical propulsion system or electronic command, control and communication system using a portable computer instead of bulky, paper manuals. Embedded Electronic Technical Manuals (EETM), which reside right in the equipment, can also aid the technician to repair that piece of equipment.